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Readiness is not all-or-none. It depends on the method and materials to be used and on the level at which instruction will begin. Maturation, heredity, and experience influences readiness, and most 6-year-olds are ready to learn something about reading. Readiness research should attempt to find what and how a child is ready to learn rather than whether he is ready to learn to read. Recommendations for improved research caution against interpreting the findings of readiness studies when the teaching method and materials are not specified, particularly when the sample is small. Researchers should avoid making misleading retrospective inferences about readiness, especially in the case of inferences of no relationship. Finally, one should not make the following faulty interpretations of correlational relationships: (1) assuming that correlational differences due to individual test suitability differences or to test reliability differences imply differences in the relationship of the underlying variables; (2) neglecting to analyze the nature of various readiness tasks and to use this information in future research regardless of the names presently given to the tasks; and (3) overlooking the importance of sampling error in multivariate analyses. References are included. (BS)

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Evaluating Readiness for Developmental Language Learning: Critical Review and Evaluation of Research

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In surveying any field of inquiry, it is helpful to begin by locating those central questions that characterize the field and give meaning to the smaller, subsidiary questions that are the focus of individual research projects. In the field of readiness, this preliminary orientation is particularly crucial, for the point of the inquiry, the purpose of the research, is widely misunderstood. It is unfortunate that this should be so, for readiness is a concept of transcendent importance in education, and misunderstanding of it has led directly to unfortunate classroom practices.

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This misunderstanding of the concept of readiness is the more surprising since the concept is a very simple one. The child is in school to learn; what and how is he ready to learn? The notion of readiness is no more than that. The question can be asked another way: "Is the child ready?" This form of the question is legitimate, but it presupposes that we have something specific that we wish the child to learn, that is, something specific that we wish him to do in the way of a learning task or experience. We want to know if he is ready, if he is prepared, for this experience. If we conceive of our methods and curricula as fixed, it is a good question to ask.

Perhaps it is our human tendency to categorize and simplify that makes us ask the readiness question this way: "Is the child ready?" But we should realize that we cannot answer this question unless we can also answer in rich detail the question, "Ready for what?"

"Is the child ready to learn to read?" This is a foolish question, for the child does not learn to read in an instant. It is a process that takes some time for any person at any age. Part way through the process he is ready to profit from experiences he would have found meaningless at the beginning.

We might then ask, "Is the child ready to begin to learn to read?" Does that question make sense? It makes sense only if we have specified precisely how reading will be taught--where we are willing to start and what possible sequences of learning experiences the school is willing to make available to the child. A particular child may be unable to hear that there are three phonemes in cat. He is surely not ready for some of the

reading programs that are based on the complete phonemic analysis of words. This child may, however, be capable of discriminating and blending certain sounds, and thus he may be ready to learn the sounds corresponding to some letters and to synthesize some words. Or he may be capable of learning to discriminate a few whole words and thus may be ready for some whole-word discrimination training, if the teacher wishes to begin in that way.

I said a moment ago that if a child could not hear the three phonemes in cat, he is not ready for some reading programs that require the complete phonemic analysis of such words. But perhaps he is capable of learning to segment speech sounds. Once he has made some progress in segmentation, he may then be ready for the training in the phonemic analysis of words. In any case, he is ready on some level to begin to learn to read

What I have been saying has been said repeatedly before. Gates (5) wrote substantially this same thing over thirty years ago. (See also (6).) Many others have said it since. (Cronbach (3) gives an excellent treatment of the concept of readiness in his elementary educational psychology text.) What they have all said in different ways is that readiness is not all-or-none; it depends on the method and materials that will be used and on the level at which instruction will begin.

Maturational factors are, of course, important in readiness, as are inherited differences in intellectual traits. But the child's experiences up to this point are also a vital factor, and the experiences he will have had by tomorrow depend upon the teacher. One is tempted to say that nearly every six-year-old is ready to learn something about reading if this "something" is carefully selected in keeping with his abilities, and if he is guided by a compassionate teacher. The teacher, knowing the eventual goals of education, should ask, What and how is this child ready to learn?" And

she should know that when you teach a child a little, he is then ready for a little more.

What Readiness Research Should Be

With this understanding of the meaning and importance of school readiness, let us now look at the research on readiness for developmental language learning. I will focus on readiness for reading, since the majority of research on readiness has had this focus, and this field illustrates well the nature of the problems in such research.

Now this point of research on reading readiness is to understand better the nature of the process of learning to read and to learn how to make helpful predictions. We would like to be able to say such things as: "This particular six-year-old has an immediate memory span of at least five letters; he is able to discriminate all the letters except b, d, p, and q; he can segment the sounds in words that are up to four phonemes long, so long as the words do not contain a nasal consonant or a semi-vowel; he can already read the common articles and prepositions by sight; he has at least the following specific words in his speaking vocabulary," and so on. "We would therefore predict that he will make good progress on learning these particular discriminations, or that he will be able to read this particular easy story, or that he can learn task X easily if he first learns task Y.

If we could make predictions of this sort with a fair degree of success, we would have achieved a far greater understanding of the process of learning to read than we now have. It will be clear to anyone who is at all acquainted with the research on reading readiness that most of this research is not oriented toward producing knowledge that will make predictions of this sort possible. Research that would produce such knowledge would be very detailed. We need it.

Let us look at what readiness research would be if it were guided by the question: "What and how is the child ready to learn?"

Readiness research based on this question would begin with a rather complete assessment of those abilities or skills judged directly relevant to some very specific segment of early reading instruction. The nature of the abilities assessed and the detail in which they would be studied would need to emerge from the research, but might be something like the abilities mentioned in the example of prediction given above. The segment of instruction would be specified in about the detail that is appropriate for a teaching machine program. The children who had been assessed would then receive the segment of instruction, and their successes and the points at which difficulties occurred would be studied. A new appraisal of each child's readiness would now reflect his initial abilities plus what he has just learned, and the children would embark on a new segment of instruction. In other research, different segments of instruction would be tried, perhaps in different orders, and the nature of the individual segments would be modified.

This procedure is, of course, similar to the theory of programmed instruction. It is quite different from much of the present practice of programmed instruction. It relies far more on prior evaluation and is focused on the qualities and prior learnings that make for success. It does not assume that all children will learn equally well from the same instructional sequence; even the most carefully programmed experience will be remembered better or generalized and applied more intelligently by some children than by others.

Such a program of research would be extremely time-consuming, but each new study, each bit of new information, would be a lasting contribution that would add to the total picture--something that cannot be said for many of the more global studies of readiness today.

What Readiness Research Has Been

Past and present research on reading readiness has been too much influenced by the less cogent form of the readiness question: "Is the child ready to begin to learn to read?" When the question takes this form, it is logical for research to take the form of assessing the child's abilities at the beginning of the first grade and comparing these with his ability to read a year or two later. Some of this work on prediction has been sound and valuable. A certain amount has been learned about the characteristics that are generally important predictors of the child's success in learning to read.

If we look at the general nature of the results of past reading readiness research, we see that many of the findings can be quite succinctly summarized: As is generally true in studies of prediction, the best predictors tend to be those tasks that are most similar to the criterion, in this case, tasks that are similar to reading itself. For example, later reading comprehension seems to be predicted better by visual discrimination of letters and words than by visual discrimination of geometric forms (1).

Why Tasks that Resemble Reading Predict

It is important to realize that there are at least four reasons for the predictive validity of the tasks that closely resemble reading. The first reason is simply that, to the extent that the criterion and predictor tasks are similar, they are likely to require the same abilities. If the predictor task is similar to reading, abilities required for success in reading will be measured by the predictor, even if it is not clear to us precisely what those abilities are. This possibility implies, again, the importance of

using more detailed, longitudinal readiness research of the sort described earlier to clarify the nature of the abilities involved, develop better measures of them, and experiment with direct teaching of these abilities.

The second reason for the predictive value of tasks similar to the criterion is that they measure the past influence of environmental and motivational factors that are likely to continue to influence in a similar way the further acquisition of reading skills. Thus, the kindergartener who has the curiosity to puzzle about and inquire about the meaning of printed words on cereal boxes is likely to be led by similar enthusiams through further successful reading experiences during the primary grades. If a child has parents who have stimulated his curiosity about printed words and who have supplied some of the answers that enable him, say, to name the letters or some letter sounds when he enters first grade, these same parents will probably continue to provide the parental interest, the encouragement, and probably even some supplemental instruction, that will foster continued progress in the development of reading skills through the school years.

Writers have given clear recognition to the importance of the background--helpful and otherwise--that the child brings to school (e.g., (8)). The continuing influence of the same environmental factors has been relatively underplayed. Schools tend to receive the entire blame for the relatively slow progress of children whose parents do not provide an environment that reinforces and supplements school instruction. Likewise, in educationally oriented communities, the school may take exclusive credit for superior achievement that has been produced in no small measure through instruction in the home.

Background factors may be important in another way that forms a third process that makes reading-like prediction tasks effective. When a child comes to first grade with some of the rudiments of reading skills, he finds the early lessons in reading easy to master, and both he and his teacher

are likely to become confident of his abilities. The teacher will, quite reasonably, regard him as able and interested and will confirm and reinforce his favorable attitudes toward schoolwork.

Fourth, what a child already knows, he cannot fail to learn. If he knows some of the basic ingredients of reading skill, he cannot, through accidents of poor teaching or absence from school, fail to learn these rudiments on which later progress will depend.

Each of these ways in which the relation between prediction and achievement of reading success is effected is worth thinking about in terms of its implications for teaching. It is not possible to discuss these implications here, but careful consideration of these four kinds of influences will suggest several helpful procedures and orienting attitudes that the teacher might espouse.

Other Predictors Are Needed Too

I have stressed the predictive value of tasks that resemble the criterion, but it is also important that we should continue trying to find new, less obvious, and more basic types of prediction tasks. Examples of promising types of predictive measures that are less obviously similar to the criterion of reading are the measures of auditory-visual integration and visual-motor coordination that have recently received much interest. The thoughtful analysis of the role such functions play should lead to the prediction of specific aspects of reading or specific stages of learning to read in which those functions should be particularly important. This type of theoretical development should in turn lead to the experimental validation of the predictors in their specific roles. From a practical standpoint, it is apparent that the more basic types of prediction task may be particularly valuable in

planning instruction for children whose home background has not prepared them for immediate success on complex predictor tasks that resemble actual reading.

I implied earlier that, in spite of the considerable volume of research on all kinds of prediction measures, we do not yet have a very clear understanding of the specific roles and the interactions of the various predictors; neither has success at prediction been particularly good (9). Robert Dykstra (4), in an excellent paper on the use of reading readiness tests, has also pointed out that the reliability of subtest scores on these instruments is frequently so low as to make their use for diagnostic purposes questionable, and that certain individual subtests typically predict later reading achievement as well as the entire readiness battery.

Shortcomings of Readiness Research

Let us now consider some of the specific characteristics of reading readiness research that have contributed to this rather poor record.

It is quite natural that research guided by the question, "Is the child ready?" should frequently fail to deal adequately with the method and materials that the children were required to be ready for. Sometimes in prediction studies the teaching method to which the results apply is described in a general way, but more often, it is not. (Even when teachers profess to be using a particular approach, of course, their actual classroom behavior may not conform to it (2).) If the teaching method is not specified, and if the number of teachers in the study is small, it is difficult to interpret the results, for the results may apply principally to children taught by the unspecified method that was used. When a large number of teachers using different methods is involved, as is often the case in the development of published reading readiness tests, the main predictive factors that are isolated may be taken as being generally important. It must be remembered, however, that one or more of these factors that are

generally important may not be important for some particular teaching method.

Another factor making some of the literature on readiness for beginning reading difficult to interpret is that inferences about readiness are often made retrospectively. Children in the third grade, for example, may be tested for visual perceptual abilities and these scores on visual perception correlated with their present reading ability. If those who read poorly have poor visual perception, it is often inferred that poor visual perception has interfered with reading achievement from the beginning. Conversely, if no relation is found between visual perception and reading achievement in these third-grade children, it is then often inferred that problems of visual perception were not a factor in the developmental history of current reading difficulties.

The problem with many retrospective inferences, of course, is that the present status of such factors as visual perception is no certain indication of their status at the time that reading instruction was initiated. There is no reason to suppose that third-grade children with poor reading ability, but whose visual perception is good, necessarily had well developed visual perception abilities in the first grade. This problem has been discussed before in relation to specific factors such as auditory perception (e.g., (10)), but we should realize that it applies generally to many factors that can influence the growth of reading. A child may be quite secure and well adjusted in the fourth grade, for example, but may have been deeply disturbed by the birth of a younger brother at the time he was receiving his initial instruction in reading.

Positive relations in the later grades between reading achievement and other traits can often give valuable clues as to traits that should be studied longitudinally for their effect on reading growth. The lack of a relation in the later grades, however, is, in most cases, no proof that the measured

trait was not influential at an earlier stage.

It should be noted, too, that correlations between test scores can change systematically with age simply as a result of one or both of the tests becoming more or, usually, less appropriate for the older children. In some recent studies of auditory and visual development, for example, what was interpreted as a decline with age in the relation between measured variables should clearly have been attributed to ceiling effects as at least one of the tests became progressively easier for the older children.

Misleading Interpretation of Data

As this last example suggests, careless interpretation of correlational relationships has hindered our understanding of the factors that predict success in reading. In fact, much of the muddle can be described in these terms. It should be helpful, then, to describe some of the most common shortcomings of interpretation.

Reading is a very complex perceptual and intellectual task. A variety of perceptual and intellectual skills that get proposed as predictors turn out to be moderately correlated with it. Until recently, most investigators were content to show that some new variable predicted later achievement above chance level or predicted about as well as some established predictor. In many cases, further study of the data would show that the new variable and the established predictor are also highly correlated and that, as far as prediction goes, the new variable makes virtually no independent contribution. There is an obvious need for some adequate factor-analytic studies that will begin to give us some indication of the independent dimensions of the many kinds of test scores that predict success in beginning reading. Once some of these dimensions are established, their respective contributions can be

studied, and we can attempt to devise ways of measuring them more directly.

Many of the recent studies of reading readiness have taken account of the interrelationships between predictors through the use of multivariate regression analysis. When the goal is to maximize prediction from a given set of tests, or to study the relative independent contributions of these tests to prediction, multivariate regression analysis is indeed an appropriate technique. This technique assigns relative weights to the different predictors that are used in a given study. These weights indicate the independent contribution to prediction that each predictor makes, and best prediction is achieved when the standard score on each predictor is multiplied by this number before the scores on the various predictors are added to give an overall prediction score. In most cases, the usual model is probably suitable, although there may be some instances where interaction terms should be considered. It is possible, for example, that interaction of auditory and visual perceptual abilities is an important term. Surely, in the extreme cases, where either auditory or visual perception is extremely poor, the weight given to the other must be affected.

The multivariate regression model is not the most appropriate one for every purpose, of course. A disability that occurs only rarely may be, for the child who has it, a severe handicap in learning to read, but this rare disability will not be given much weight by the typical multivariate regression analysis.

The use of multivariate techniques should have speeded our understanding of reading readiness predictors, but this achievement seems to have been delayed by our <u>lack</u> of understanding of the multivariate techniques themselves.

First of all, there is the problem of sampling error. We should realize

that the weight that is eventually assigned to each predictor depends on the intercorrelations among all the variables involved, and that it takes a large N to produce reasonably stable correlations. The weights that are derived from one sample, will not, in general, be the optimal weights for another. The general tendency has been for investigators who would ordinarily be scrupulous in recognizing the importance of sampling error to speak of sample regression weights as fixed numbers and to interpret with seriousness even minor differences between the weights for different variables. It should be clear that we should be cautious about discarding a particular test as relatively useless simply because it does not achieve a significant weight in a particular regression study.

In addition to the problem of sampling error, there is the problem of the relative reliabilities of the particular tests used. In exploratory studies, the individual tests may vary considerably in reliability. One test may be a carefully developed, standardized test, another may be relatively short and somewhat crudely put together for the purpose of the specific study. The relatively low reliability of the shorter, rough-and-ready test will limit its correlation with the criterion (and also its correlation with the other predictors). Such a test may receive a low weight in a multiple regression equation primarily as a result of its low reliability. Improving the reliability of such a test is often a simple matter, and this improvement may result in the assignment of a notably higher regression weight. For example, several of the experimental tests of auditory discrimination, auditory-visual integration, and other such functions that have recently been tried as predictors of reading achievement, have been just too easy to be reliable measuring instruments for beginning first graders.

Their reliability could probably be improved by increasing their difficulty to a suitable level, a change that would increase their regression weights in most of the studies in which they have been included.

It would clearly be helpful if researchers would report the reliability of the predictors involved. Many current studies do not even include any attempt to evaluate reliability. It would also be helpful, in the case of factor analytic and multiple regression studies, if journal editors would provide space for, and encourage, the publication of complete intercorrelation matrices. Where theoretical rather than practical considerations are paramount, it would be desirable to supplement the analysis with factors or regression weights based on intercorrelations that have been corrected for unreliability. This policy would reduce the likelihood of discarding promising variables simply because the first try at measuring them was relatively unsuccessful.

Related to the problem of discarding promising variables because of readily correctable low reliability is the problem of discarding constructs because the particular test that is used does not, for some reason, give a valid estimate of it. Of course the reverse of this problem is also common. It is well recognized, for example, that in factor analytic studies there is a great temptation to look for some factor that can be labeled with the name of the investigator's pet construct.

Confusion from Test Labels

The last of the obstacles to progress in reading readiness research that I will discuss is the problem of mislabelled tests. We should not be misled into unproductive research by accepting at face value the name given by previous investigators to any particular test. For example, in one recent study, a letter naming test was labeled as a visual discrimination task.

Undoubtedly letter naming involves visual discrimination, but it surely also involves extended past learning of specific stimulus categories and appropriate responses. The new Gates-MacGinitie Readiness Skills test (7) contains a subtest called "Visual Discrimination" that might more properly have been called "Visual Discrimination of Words," if that name did not also have other established uses. The IRA might play a helpful role by developing a taxonomy of test tasks and corresponding nomenclature.

One specific difficulty with test labels is that many tests with other names are, in fact, primarily tests of memory span or tests of ability to follow directions. A test that is called "auditory-visual integration," but that makes considerable demand on memory or on ability to understand verbal directions, will correlate fairly well with reading achievement whether "auditory-visual integration" is itself a good predictor or not. The actual nature of the predictor can of course be better understood when its correlations with several other measures are known. In interpreting any reading readiness research, there is no more important rule than to bear in mind the actual tasks that the children were given, regardless of the names that the investigator has given those tasks.

Summary of Recommendations

I have made a number of general criticisms of current reading readiness research. I have purposely not singled out particular studies. My aim was not to find fault with past work, but to encourage more informed and discriminating evaluation of past and future readiness research and to encourage more meaningful future research by pointing out both past pitfalls and more appropriate goals.

Let me summarize, now, the cautions I have urged for interpreting readiness research and the suggestions for a future redirection of such research.

First, it is hazardous to interpret the findings of readiness studies

when the teaching method and materials are not specified, particularly when the sample is small. Second, retrospective inferences about readiness can be misleading, especially in the case of inferences of no relationship. Third, a number of faulty interpretations of correlational relationships need to be avoided:

(1) Differences in correlations due to differences in the suitability of the test for different groups of children, or differences in correlations between predictors and a criterion due to differences in test reliabilities, should not be taken as necessarily implying differences in the relationships of the underlying variables.

(2) It should be recognized that performance on many different tasks has some relation to later reading achievement. The interrelations of the tasks need to be studied and the major independent predictors identified. The actual nature of the tasks should be analyzed, and further research should be based on this analysis not on the names that happen to have been given to the tasks.

(3) The influence of sampling error in multivariate analyses should be taken seriously, and particular predictors should not be selected or rejected without taking sampling error into account. Sample size, which influences sampling error, should be commensurate with the nature of the variables and the purposes of the study.

Careful attention to these cautions in readiness research would greatly improve our understanding of factors that are generally predictive of achievement in beginning reading. Fundamental progress in prediction and in sound understanding of the process of learning to read, however, hinges on a reconceptualization of readiness research that is long overdue: The question underlying explorations of readiness should become "What and how is this child ready to learn?" Only when we have learned to ask the right question will we begin to get more meaningful answers.

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